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⑤④ Method of mounting printing cylinders utilizing flexible metal sleeves and printing apparatus using such a printing cylinder.

⑤⑦ Printing apparatus of the type utilizing flexible, readily collapsible, imperforate thin metal sleeves wherein the sleeves are mounted in a device which maintains their cylindrical configuration rigidified by introduction of fluid under pressure interior of the sleeve during use.

A method of mounting the sleeve (10) and several structures for supporting the sleeves are described. These include the provision of means in the printing press cooperating with the sleeves for maintaining its interior pressure and for stopping the press if the pressure should drop below a predetermined value. The sleeves may carry an exterior coating of flexible, microcrystalline, wholly inorganic photoconductive material such as sputtered ultra-pure cadmium sulfide.

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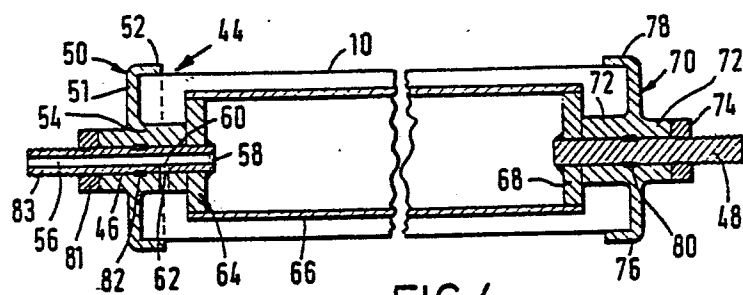


FIG. 4

- 1 The invention is concerned generally with printing apparatus which include cylinders for transferring of pigment to a substrate using electrostatic techniques.
- 5 The invention is advantageously utilizable in the printing of multicolor images on substrates which are either in long strip form or in the form of sheets of paper, fabric and the like.
- 10 Multicolor printing by conventional presses is a complex process from the point of making the color separations, forming the cylinders, operating the presses, providing the pigment or inks for the separate cylinders or other plates, etc.
- 15 Several developments in recent years have pointed to the use of electrostatic techniques for multicolor printing in printing presses using electrostatic techniques. As known, photoelectrostatic imaging is effected by charging
- 20 the surface of a photoconductive coating in darkness, exposing the same to a light image, then toning the latent image with fine particles either in powder form or suspended in a solvent. The toned or developed image can either be transferred to a receptor or it can be fused
- 25 in place directly onto the electrophotographic member of which the photoconductive coating is a part.

One of the coatings which has been evolved recently is a high gain, high resolution, easely charged, fully

1 dischargeable, wholly inorganic, microcrystalline photo-
conductive material which has especially the property
that it is rugged and extremely flexible when coated
onto a thin flexible substrate. The material is disclo-
5 sed in U.S. Patent 4.025.339. This coating is advanta-
geous in addition to being flexible in that it can be
imaged quickly in a high speed press and discharged
readily by ambient light so that, as will be explained,
it can be provided with an image of toner that is insu-
10 lating and thereafter charged to apply a charge to the
insulating toner while permitting the charge on the un-
toned areas to be dissipated in light. Secondary toner
then can be adhered to the primary toned image and
transferred to a substrate.

15
Thin-walled metal sleeves of electrodeposited nickel,
copper, iron or other metal have been used in the fabric
and other substrate printing field with success. Sleeves
of plated metal may be used, such as for example, tin,
20 chromium or other metals as nickel. These sleeves are
a fraction of a millimeter thick and can be several
meters long and as much as a third of a meter in dia-
meter. They are seamless and are readily supported in
printing machines.

25
One type of sleeve is disclosed in U.S. Patent 2.287.122.
Such sleeve is foraminous in order to enable ink or
other pigment to be expressed by doctor means through
the walls of the cylinders onto the passing substrate.
30 The walls are provided with suitable designs in the
surface blocking certain of the holes and leaving others
open.

35
For electrostatic use, these sleeves are sputtered
with coatings of the photoconductive material which has
been mentioned and are imperforate. An important ad-

- 1 vantage of this type of sleeve is that it is light in
weight, it is quite strong and is collapsible so that
packing and shipping the same is economical.
- 5 In using the sleeves, they must be mounted in cylindri-
cal form on the printing press to receive and transfer
the pigment, and must be supported on their interiors
by using some readily installed or removed device to
mainrain the sleeves in rigid cylindrical form during
10 use.

Reference is made to Rothwell U.K. Patent 789.177, pub-
lished January 15, 1958; Klemm W. German Auslegeschrift
1.231.258 published December 29, 1966; Zimmer Austria
15 Patent 240.879 and Zimmer W. German Auslegeschrift
1.181.237, for a description of some devices wherein
sleeves are pressurized by means of an inflatable tube.
As evidenced by these publications the cylinders there-
in are described processed to have a pattern applied
20 on their exterior (U.K. 789.177; DAS 1.181.237; Austria
240.879) or to produce a sleeve in a galvanic process
(DAS 1.181.237). The U.S. Patent 3.312.801, March 12,
1968 may be referred to as concerned with the packing
of flexible sleeves.

25
Considerable difficulties in providing structure for
mounting such collapsible sleeves in a high speed
printing press have deferred their use functionally in
such press device, not withstanding the considerable
30 advantage thereof as mentioned earlier herein.

Accordingly the invention provides a method of mounting
an elongate flexible thinwalled metal sleeve on a frame
for use in a rotary printing press, characterized by the
35 steps of providing a rotatable framework including a
device for shaping the sleeve into a cylinder; engaging

1 the sleeve over the framework; forming the ends of the
sleeve into circles; sealing the ends; containing the
ends against axial movement and applying fluid pressure
on the interior of the sleeve to inflate the same with
5 uniform incremental internal pressure along said interior thereof.

Concurrently, the invention also provides the mounting
method according to claim 1, characterized in that the
10 sleeve is unsupported along the remaining length between the ends of said sleeve.

Further, the invention provides a printing press employing the said sleeve mounting and characterized by
15

A. an elongate framework including shaft means having opposite ends for connecting the framework into a printing press to be rotated thereby, a disc member at each end of the framework connected respectively to one of said shaft ends and each disc member adapted to have one end of a thin-walled metal sleeve coupled thereto and circularly shaped thereby and an axially extending spacer connected between said shaft ends for fixedly
20 spacing the disc members apart and maintaining the spacing during the use of the apparatus,

B. the axially extending spacer being arranged to have such a length as to form the sleeve into cylindrical configuration in cooperation with the members and
30

C. means for applying a uniform pressure on the interior of the sleeve to every increment thereof over the entire area thereof between said ends in order to maintain its cylindrical configuration during use of the apparatus.
35

1 Additionally the invention provides the printing press
further including the apparatus characterized in that
the axially extending spacer means comprise an elongate
rigid cylinder whose outer diameter is less than the
5 inner diameter of the sleeve which is adapted to be
supported by the apparatus whereby there will be a cy-
lindrical space defined between the outer surface of
the rigid cylinder and the inner surface of the sleeve
when it is installed, the said pressure being supplied
10 into said cylindrical space and the sleeve thereby be-
ing mechanically unsupported throughout its major length
during use;

and also the apparatus, characterized in that said means
15 for applying pressure include means for introducing
fluid under pressure in the framework and transmitting
the pressure to said cylindrical space when the sleeve
is installed in place.

20 For a complete understanding of the invention preferred
embodiments are described with reference to the accompa-
nying drawings.

Figure 1 is a perspective view of a sleeve of the type
25 which is to be mounted by means of the apparatus of the
invention and held in a rigid cylindrical configuration
to enable the same to be used as ink transfer means in
a printing press;

30 Figure 2 is a sectional view through several of such
sleeves showing the convenient manner in which they may
be assembled for storing or transportation in small
space;

35 Figure 3 is a highly diagrammatic view of a printing
press having two of the cylinders of the invention asso-

1 ciated therewith in order to show the environment of
the invention;

Figure 5 is a similar view but partially exploded of
5 a modified form of the invention;

Figure 6 is another similar view of a further modifi-
cation of the invention;

10 Figure 7 is a sectional view similar to that of Figure
6 showing a variation of the structure of Figure 6;

Figure 8 is a median sectioned view through a printing
apparatus taken generally along line 8-8 of Figure 9
15 and in the indicated direction, parts being taken away,
and illustrating another modification of the invention;

Figure 9 is an endelevational view of the apparatus of
Figure 8, view taken from the left hand side;
20

Figure 10 is a fragmentary detailed view of the sleeve
clamping means of Figures 8 and 9 and

Figure 11 is a highly diagrammatic view of a printing
25 press having the sleeve of the invention installed
therein, there being means for utilizing a source of
external pressure operable by external control means.

30 In Figure 1 there is illustrated in perspective view
the type of cylinder 10 which is used with the inven-
tion, the same being based upon a sleeve 12 which has
been formed by electrodeposition out of nickel, copper
or the like, being quite thin - of the order of a small
35 fraction of a millimeter and hence flexible or may com-
prise a naked sleeve plated with such metals as tin
chromium or thus.

1 Upon this sleeve 12 there is sputtered a thin film coating 14 of a wholly inorganic, microcrystalline, highly sensitive, readily chargeable photoconductive material such as for example ultrapure cadmium sulfide. The characteristics of the material and the method of sputtering the same are disclosed in said U.S. Patent 4.025.339. The techniques for the electrodeposition of the metal sleeve 12 and some of the characteristics thereof are described in said U.S. Patent 2.287.122 with the exception that the metal sleeve 12 is imperforate instead of foraminous as disclosed in said latter patent.

In the formation of the metal sleeve 12 the resulting product is normally cylindrical and likewise, in sputtering the coating 14 the configuration of the sleeve 12 will be maintained in cylindrical form. It is possible for the sputtering to be carried on with the metal sleeve 12 forming the substrate for the coating in an oval configuration.

20 In the mounting of the sleeve or cylinder 10, it will invariably be in a cylindrical configuration for high speed printing presses, especially multi-color presses. Nonetheless the sleeve 10 is to some extent collapsible without damage to either the substrate of metal or the coating of microcrystalline photoconductive material. The metal substrate comprising the sleeve 12 is stiff enough to handle, for example in a size which has a length of about two meters and a diameter which is about a sixth of a meter without axial collapsing or wrinkling, but can be readily compressed or collapsed laterally along its entire length to enable it to be shaped for example into oval form as shown in Figure 1. Likewise it can be partially rolled into reentrant shapes to occupy considerably less volume than when it is in its full cylindrical configuration as disclosed in U.S.

1 Patent 3.372.801. This enables many of these sleeves to
be packaged in a single small package as shown in Figure
2 in which there are two additional sleeves 10' and 10''
within the sleeve 10. Obviously more than two such slee-
5 ves can be compressed into a single bundle.

Reference is made now to Figure 3 which illustrates the
environment in which the sleeve 10 is intended to be
used. Here as an example a printing presse 16 is shown,
10 this being of a type which is intended to apply two co-
lors of ink or dye carried in the fountains 18 and 20 in
registration on a long strip-like substrate 22 of paper
or the like. The substrate 22 is guided by means of the
rolls 24, 26, 28 and 30 to pass around a back-up roll 32
15 against which the printing will occur. Two cylinders of
the type described are shown at 10 and 10'''. The di-
rection of rotation of the drum 32 is indicated by the
arrows 34, the direction of each of the cylinders 10
and 10''' being indicated by arrows marked on the cy-
20 linders.

In this apparatus 16, the cylinders 10 and 10''' will be
presumed to have images carried on their outer surfaces
as primary toned images. These can be applied while the
25 cylinders 10 and 10''' are off the apparatus 16 and the
cylinders thereafter installed in the apparatus.

In use the cylinders are charged by suitable corona
means at 36 and 38, the charging occurring in light so
30 that the charges on the photoconductive coatings are
immediately dissipated leaving only the charges on the
primary toner. The type of toner chosen is one which is
insulating when developed, that is, fused. The fountains
18 and 20 contain the ink or dye which comprises the se-
35 condary toner. The polarity of the particles of the se-
condary toner is established as the opposite of that of

1 the charge on the primary toner. This can be done elec-
trophoretically or by triboelectric techniques. As the
charged images pass the fountains 18 and 20 they will
pick up the secondary toner from the respective foun-
5 tains and apply the same to the surface of the substrate
22. Electrical bias can be used to assist in this trans-
fer. Transfer will be done in registration.

After the transfer has been completed and the images
10 pass the nip between the cylinders and the back-up rol-
ler 32 the printing cycle is repeated. Although not nor-
mally required, remaining secondary toner, if any, may
be removed from the surfaces of the cylinders 10 and
10''' by suitable solvents or mechanical means at sta-
15 tions 40 and 42, with suitable solvents and/or mechanical
means which do not affect the primary toner.

The cylinders 10 and 10''' could be provided with deve-
loped toned images and treated with suitable reagents
20 or chemicals to render the toned surfaces hydrophobic
and the untuned surfaces hydrophillic to enable the cy-
linders to be used as printing cylinders with greasy
ink in watered offset printing presses. The use of the
cylinders in the type of printing apparatus operating
25 by means of electrostatic techniques is preferred.

As heretofore mentioned, the cylinder 10 is required to
be perfectly cylindrical and relatively rigid during
its use and with its mounting or support, should be
30 easily installed and removed from the printing press on
which it is to be used. Likewise, it is required to be
easily installed and removed from the mounting which
carries it.

35 In Figure 4, there is illustrated (in section) a form of
mounting upon which the cylinder 10 is arranged for use

1 in a printing press. The mounting device 44 basically
comprises a device in which the cylinder is suspended
in cylindrical configuration and is kept inflated by
means of a fluid such as oil or air or the like pumped
5 into the interior of the cylinder 10 and maintained at
a low pressure. It has been found that the cylinders 10
can be kept quite rigid and maintain their cylindrical
configuration by means of pressures only slightly greater
than atmospheric, say of the order of .5 to .7 of
10 an atmosphere greater than ambient. This is considered
a surprising result.

The cylinder ends must be tightly gripped in cylindrical
configuration to prevent wrinkles and bulges.

15 In Figure 4 the mounting device is basically formed of
two stub shafts 46 and 48, shaft 48 being solid and
shaft 46 being hollow. A flanged disc 50 has an inward-
ly directed annular cup-like flange 52 whose interior
20 diameter is very closely the outer diameter of the
sleeve 10. A hub 54 mounts the web 51 of the disc 50
on the hollow shaft 46 non-rotatively, the center of
the shaft 46 having a through bore 56 whose inner end
may be plugged at 58 but which is provided with a lateral
25 opening at 60 that connects with a radial passage-
way 62 passing through the hub 54 but located axially
interior of the web 51 of the disc 50, the web 51 being
imperforate.

30 The interior end of the shaft 46 also has a large washer
64 secured thereto as by welding, the washer 64 supporting
an elongate rigid metal cylinder 66 and being secured
thereto, also by welding, for example. This cylinder
is included in the term axially extending spacer
35 means as employed herinafter.

1 The opposite end of the cylinder 66 is attached to a
second washer 68 that is welded to the shaft 48 so that
both shafts 46 and 48 are aligned and rotate in unison.
A second disc 70 has a central hub 72 that may be secu-
5 red to the shaft 48 permanently or non-rotatable rela-
tive thereto but held in place by a nut such as 74. The
body 76 of the disc is imperforate and has an inwardly
directed cup-like annular flange 78 at its outer peri-
phery having the same interior diameter as the flange
10 52.

Suitable packing is provided at 80 and 82 serving to
prevent the leaking of fluid outwardly of the discs 50
and 70.

15 The disc 50 is held in place by the nut 81 engaging over
the threaded end 83 of the shaft 46.

In use, a sleeve 10 is shaped into a cylinder and fitted
20 into the interior of the flange 78 and cemented in place
with a suitable adhesive, primarily to render the teles-
coping connection fluid tight. The flange 50 is not in
place at this time. After installing the right hand end
of the sleeve 10, the disc 50 is moved telecopically
25 over the left hand end of the sleeve 10 and again the
connection is effected with a coating of adhesive in
place to provide a second fluid tight connection. When
the adhesive has set, the entire assembly is installed
in a printing press such as the apparatus 16 and a
30 fluid such as air, hydraulic fluid or the like is ad-
mitted into the bore 56 through a suitable fitting
attached to the left hand end of the shaft 46. This
fitting is required to maintain the connection fluid
tight while rotating, there being many such fittings
35 known in the art. Such a fitting is indicated at 57,
connected by line 59 to the fluid source 61.

1 The fluid is carried in the annular space between the
central cylinder 66 and the sleeve 10 and it serves to
maintain the sleeve 10 fully inflated and rigid during
use. The presence of the inner sleeve enables a very
5 small amount of fluid to be used to maintain the rigi-
dity of the sleeve 10, and in the case of air or other
gas being the fluid, the amount of pressure needed to
maintain the inflated condition is lower than it would
be if the shaft extended fully through the device and
10 there was no cylinder 66. It is clear that the cylin-
der 66 functions to maintain the spacing between the
discs 50 and 70 and to keep the shafts 46 and 48 in
alignment and rotating together. The entire assembly is
included in the term "framework" is used.

15

The internal pressure needed for keeping the cylinders
inflated on a printing press is so low that readily
available air pressure from commercial sources commonly
provided in shops and factories will suffice. Further,
20 since the method of transfer of ink to the substrate
requires no mechanical pressure in the preferred struc-
ture in which the cylinders will be used, mechanical
tension alone will be adequate to maintain the cylin-
ders in their normal configuration in many instances.

25

Two other forms of the invention are illustrated,
respectively in Figures 5 and 6, but the principals of
construction and operation are basically the same for
all of the cylinder supporting devices including that
30 of Figure 4. Each has means for clamping or seizing
the ends of the cylinder 10 in a fluid tight connection
while shaping the same to form the cylindrical configu-
ration, each has means for admitting a fluid to the
interior of the cylinder to inflate it if required but
35 at least to maintain it in rigid cylindrical configu-
ration, and each has means for mounting the device onto
a printing press. It should be understood that although

1 the practical manner of introducing the fluid and main-
taining the internal pressure is by having structure
on the printing press which connects with the cylinder-
supporting device while the cylinder is rotating, it is
5 nevertheless possible to have the cylinder-supporting
device provided with means that pumps the fluid into
the interior of the cylinder and is sealed under some
pressure so that the entire device is maintained in tis
fully expanded condition independently of the printing
10 machine.

The mounting devices 90 of Figure 5 differs primarily
from that of Figure 4 in that the ends of the cylinder
are held in place pneumatic or hydraulic expandable
15 cushions. There is a pair of stub shafts 92 and 93
which have the interior rigid cylinder 94 secured to
their inner ends, respectively, but both of these shafts
are hollow. The right hand shaft 93 has a single bore 96
which connects to one or more radial passageways 98 in
20 the washer end 100 of the cylinder 94 leanding to the
interior of an inflatable elastomeric cushion 102 clam-
ped to the end of the cylinder 94 by suitable bands 104.
The securement can be effected by room temperature vul-
canizing adhesive or other adhesive.

25

A similar cushion 106 shown in deflated condition is
provided on the left hand end of the cylinder 94, since
this end is shown in condition while it is being assem-
bled. The shaft 92 differs from the shaft 93 and that of
30 Figure 4 in that it has concentric passageways, there
being a central bore or pipe 108 and a larger telesco-
ping second bore 110, these being located within one
another and being independent of one another. The cen-
tral passageway formed by the bore 108 is connected
35 through a fitting 112 by way of a short length of con-
duit 114 through the interior of the cylinder 94 to a

1 lateral opening 116 to which it is connected by a suitable fitting 118. The outer bore 110 connects to one or more radial passageways 120 leading to the interior of the cushion 106.

5

Assembly is effected by moving the end cup-shaped discs 122 and 124 into telescoping engagement with the cylinder 10 taking up on the nuts 126 and 128, introducing a first fluid into the bores 96 and 108 to inflate the cushions 104 and 106 to clamp the sleeve 10 in place and thereafter introducing a second fluid into the interior pipe 108 to maintain the sleeve 10 as a rigid cylinder. The second fluid is held between the inner cylinder 94 and the interior of the sleeve 10. Shaft packing is not deemed necessary in the device 90.

15

In Figure 6 there is illustrated a device 140 which utilizes an elastomeric boot of cylindrical configuration to maintain the sleeve 10 rigid so that no fluid will be engaged against the interior of the sleeve and so that it is not essential that the engagement of the sleeve 10 in the end discs be fluid tight. In this device there is again an inner rigid cylinder 142 connected with a pair of end stub shafts 144 and 146 upon which there are engaged the discs 148 and 150 by means of the nuts 152 and 154, respectively. On the exterior of the cylinder 142 there is mounted an elongate elastomeric sleeve-like boot 156 whose ends are tight clamped to the exterior of the cylinder 142 by any suitable means such as the annular band 158 and 160. The hollow bore 162 of the shaft 146 terminates axially within the cylinder 142 at 164 at which point it is connected by way of the conduits 166 connected at 168 to openings in the side wall of the cylinder 142, as for example at 170. Accordingly passage for fluid from the exterior of the cylinder 142 is provided by way of the bore

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1 162 to the chamber 172 formed on the interior of the
boot 156 and the outer surface of the cylinder 142.

The assembly of the device 140 and the method of infla-
5 tion are easily effected since everything may be in
place at one end, say the right hand end, the sleeve 10
slipped in place into the cup of the disc 150 while no
fluid is present, the second disc 148 telescopically
engaged over the left hand end of the sleeve, the nut
10 152 screwed home and fluid applied. This inflates the
boot 156 and rigidifies the sleeve 10. This will form
a rather firm base for the sleeve 10 during use.

In Figure 7 another device 240 is illustrated in which
15 the equivalent components of Figure 6 are designated by
the same second and third numerals and the numeral "2"
as the first. The principal differences between the
devices 140 and 240 lie in the fact that the entire
interior of the cylinder 242 carries the fluid, which in
20 this case is a gas and the fact that the end washers of
the cylinder 242 function both as such washers and the
discs 148 and 150. Thus they carry reference numerals
248 and 250. The fluid is admitted by way of bore 262
in shaft 246 and finds its way into the chamber 172
25 through passageways 270.

The structure 240 is advantageous in eliminating parts
comprising outer cup-shaped discs so that there need be
no part of the device 240 protruding radially beyond
30 the sleeve 10 itself. Thus the device is lighter in
weight, simpler to construct, and more economical than
the device 140.

In Figures 8 to 10 a modified embodiment of the inven-
35 tion is designated generally by reference character 300
and comprises a central hollow shaft 312 of metal having

1 a plurality of lateral passageways 313 for air. Other
fluids may be used, but for convenience only air will be
referred to herinafter because it is most convenient to
use the same in printing establishments.

5

The ends of the central shaft 312 are closed off by
plugs 314 and 316 to which the shaft is welded as indi-
cated at 318 and 320, respectively. A flanged disc is
connected to each of these plugs by suitable means, the
10 disc 322 being shown on the left and the desc 324 on the
right. These discs 322 and 324 are identical and their
construction and functions will be explained in detail
later. At this point it is to be noted that the plugs
314 and 316 are generally cylindrical and that each of
15 the discs 322 and 324 includes a hollow cylindrical hub
shown at 326 and 328 which telecopically engages the
respective plugs 314 and 316 on the exterior thereof,
airtight connection being maintained by suitable packing
such as O-rings 330.

20

The discs 322 and 324 include internal radial strengthe-
ning ribs 332 and 334 integral with the web or body of
each disc, the latter being imperforate to retain the
air pressure which is to be maintained on the interior
25 of the device 300.

As noted, the structures at opposite ends of the shaft
312 are different. These represent embodiments of the
invention capable of being used together or separately.
30 In other words, the structure at the left hand end may
be used solely or duplicated at the right hand end; the
structure at the right hand end may be used solely or
duplicated at the left hand end; one of each structure
may be used together at opposite ends.

35

1 Considering now the structure at the left hand end of
the device 300, the plug 314 has a cylindrical axial
recess formed in its outer end at 336 and a coaxial
socket 338 in the center of the recess 336 in which
5 there is disposed a simple air valve 340 of the so-called
Schraeder type which communicates by way of the
passageway 342 with the interior 344 of the hollow
shaft 312. As explained, the shaft has the lateral
passageways 313 by means of which the outer annular
10 chamber 346 and the inner chamber 344 are in communication.
As understood, a thin metal sleeve 348 of electrodeposited
nickel or the like with an outer photoconductive coating
is adapted to be clamped into cylindrical configuration on
the device 300 and maintained
15 in inflated condition by air pressure. This is effected
by introducing air under pressure by way of the valve
340 into the chamber 344.

The disc 322 has an inwardly directed radial flange 349
20 which is engaged over the axial end of the plug 314 and
provided with perforations and threaded sockets to aid
in the assembly of the device. For example, in the device
shown, there is a perforation in alignment with each of
the ribs 322 thus providing six equally spaced
25 perforations aligned with threaded sockets in the axial
end of the plug 314. One such perforation is indicated
at 350 and a threaded socket at 352.

These perforations and sockets receive machine screws
30 354 which pass through an outer cap or centering flange
member 356 thereby securing the disc 322 to the plug
314.

The centering flange member 356 has a central spigot
35 358 which is cylindrical on its exterior to fit into the
recess 336 and is tapered on the interior as indicated

1 at 360 and provided with a keyway at 362. There is also
a radial flange portion 363 overlying the flange 349.
The member 356 has the aligned perforations in the flange
portion 363 for the screw 354 but in addition has
5 several other perforations 364 which are intended to be
aligned with threaded sockets 366 formed in the flange
349 to receive other machine screws 368 that pass through
the flange portion 363. These screws 368 are only three
in number as shown in Figure 9 and their function is to
10 enable the proper alignment of the disc 322 and the
flange member 356 but more importantly, to aid in
assembly. The two parts 322 and 356 can be assembled
together before the disc 322 is engaged onto the plug.

15

Looking now at Figure 12 which is an enlarged view of
the outer section of the disc 322, there is an annular
thickened rim 370 which has an interior (on the right
20 hand face) axially extending annular seat or groove 372
formed fully around its circumference and coaxially
centered. There is an elastomeric ring 374 seated in
the bottom (left hand end) of the groove 372, the ring
374 being provided with spaced passageways 376 aligned
25 with perforations 378 provided in the rim 370 and opening
to an external shallow furrow 380 provided on the
exterior of the rim 370. There is a pressure ring 382 of
cylindrical configuration which has a plurality of
threaded studs 384 secured into its left hand axial end
30 in spaced circumferential position to align with the
passageways 376 and perforations 378. The studs 384
extend through these passageways and perforations when
the ring 382 is assembled to the disc 322 and are engaged
by the nuts 386.

35

Before the nuts 386 are tightened, the assembly of the

- 1 apparatus 300 with the sleeve 348 is effected, the
sleeve 348 being easily slipped into place as the
assembled disc 322, flange member 356 and ring 382, and
properly positioned. Thereafter, taking up on the nuts
5 386 presses the ring 382 against the elastomeric ring
374 which expands in attempting to extrude out of the
groove 372 thereby firmly clamping the sleeve 348 in
place.
- 10 Assuming that the same structure and procedure has been
utilized in assembly of the right hand end of the device
300, it can be pumped up to a pressure of say about half
an atmosphere through the use of the valve 340 and in-
stalled in the printing press. The tapered socket 362
15 provides for centering and the keyway provides for po-
sitive driving of coupling of the device with suitable
mechanical driving means associated with the printing
press.
- 20 The right hand end of the device need not have a valve
equivalent to the valve 340 but could have a blind end
in the equivalent of the tapered socket 360 in the
axial end of the plug 316. As a matter of fact, there
need not be a second keyway at this location.
- 25 In the view of Figure 8, however, a second form of
structure is illustrated which enables various functions
to be effected by means of another valve.
- 30 Referring now to the right hand end of the device 300
shown in Figure 8, the only structural difference bet-
ween that end and the left hand end lies in the valve
device mounted at the right hand end. There is a valve
housing 390 set into the right hand plug 316 which has
35 a port 392 leading to the chamber 344. The movable val-
ve 394 is seated at the right hand end of the chamber

1 396 by means of the O-rings 398 against the axial intake
port 400 and held there by a spring 402. The spring 402
is of a strength to maintain any pressure which is in
the chamber 344 and 346 if the device 300 is removed
5 from a press in which it is installed. When installed
in a press, the stem 404 of the valve member 406 pushes
the valve 394 off its seat and holds the port 400 open.

The valve member 406 has a coaxial passageway and it-
10 self is slidable in the port 400, being kept air tight
therein by suitable O-rings. Its external face 410 has
O-rings to enable it to make a frictional and air tight
connection with a fitting that can supply external air
pressure to the device 300. The fitting is not shown in
15 Figure 8 but is symbolized by the fitting 412 in Figure
11 as a rotary air connection. The spring 402 keeps the
valve member 406 in engagement with the fitting 412.

From this discription it is obvious that air can be
20 maintained and supplied to the interior of the sleeve
348 through the valve member 406 from outside sources
to pump up the sleeve 348 and maintain it in such con-
dition.

25 Referring to Figure 11 a printing press is shown dia-
grammatically having the device 300 installed therein,
the structure being such as to utilize an external
source of pressure. The other device of the invention
previously described may be utilized so long as they
30 utilize an external source of pressure. The device 300
is shown mounted on the frame 414 of a printing press
416, only a very small part of which is diagrammed. The
substrate in the form of a web of paper 418 is being
guided through the press 416 and may pass over idler and
35 drive rollers, an idler roller being indicated at 420
and a drive roller being indicated at 422 mounted to

1 the frame 414. The press drive 424 may be mechanical,
electrical, pneumatic or a combination of these, suitab-
ly controlled as customary with modern printing pres-
ses. The mechanical drive extending to the several ro-
5 tary parts is indicated by the broken lines 426.

A pressure source is shown at 428 supplying pressure to
the fitting 412 by way of the pressure regulator 430
and the air line 432 and 434. The exact pressure within
10 the sleeve 348 will be controlled by the pressure re-
gulator 430 whose set value may be established manually
as by a control 436 or may be varied automatically for
certain purposes by way of the line 438.

15 The pressure switch 440 is sensitive to sudden changes
in the pressure in the line 434, being connected to the
line 434 by a conduit 442. A large hole suddenly occur-
ring in the sleeve 348 or the bursting thereof will
cause a sudden dropping of pressure in the chamber 346.
20 The drop will be experienced by the line 434 and the
regulator will attempt to equalize the pressure. This
radical change sensed by the switch 440 can be made to
operate the switch to turn off the press drive and
prevent damage.

25 Slight air leaks in the chamber 346 can be taken care
of by the regulator 430 as a routine matter.

The press 416 will normally have some form of trans-
30 ducer system (not shown) to indicate registration of
multiple impressions and a signal from such system can
be picked up and transmitted by a line, electrical or
pneumatic, as shown at 444 to a sensor 446. This sensor
446 may in turn provide a signal which operates a re-
35 gister adjusting device 448 which is nothing more than
an automatic adjustment for the set point of the pres-

1 sure regulator. It has been found that since the sleeve
448 is made out of metal that is very thin, it is capa-
ble of being inflated slightly beyond its normal dia-
meter by a small amount, say a few thousandths of a
5 millimeter. Registration can be affected by this means,
to augment ordinary registration control means rather
than to replace the same.

The pressure adjustment effected by the register adjust
10 device 448 is applied to the pressure regulator 430 by
way of the line 438.

Finally it is stated that, hereby, the subject matter
of the attached claims is made part of the disclosure
15 of this specification without reiterating the wording
of said claims.

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Claims

1. A method of mounting an elongate flexible thin-walled metal sleeve on a frame for use in a rotary printing press, characterized by the steps of providing a rotatable framework including a device for shaping the sleeve into a cylinder; engaging the sleeve over the framework; forming the ends of the sleeve into circles; sealing the ends; containing the ends against axial movement and applying fluid pressure on the interior of the sleeve to inflate the same with uniform incremental internal pressure along said interior thereof.

2. The mounting method according to claim 1, characterized in that the sleeve is unsupported along the remaining length between the ends of said sleeve.

3. The mounting method according to claim 1 or 2, characterized in that the fluid pressure is applied directly to the interior of the sleeve.

4. The mounting method according to claim 1 or 2, characterized in that the fluid pressure is applied indirectly to the interior of the sleeve by introducing an inflatable body within the sleeve and introducing fluid under pressure to said inflatable body whereby to apply pressure to said sleeve interior sufficient to rigidify the same.

- 1 5. A printing apparatus including a support for an
imperforate thin-walled metal sleeve for use as an
ink transfer device, the sleeve being flexible and
collapsible when unsupported, characterized by.
- 5
- A. an elongate framework including shaft means
having opposite ends for connecting the frame-
work into a printing press to be rotated thereby,
a disc member at each end of the framework
10 connected respectively to one of said shaft
ends and each disc member adapted to have one
end of a thin-walled metal sleeve coupled
thereto and circularly shaped thereby and an
axially extending spacer connected between said
15 shaft ends for fixedly spacing the disc members
apart and maintaining the spacing during the
use of the apparatus,
- B. the axially extending spacer being arranged to
20 have such a length as to form the sleeve into
cylindrical configuration in cooperation with
the disc members and
- C. means for applying a uniform pressure on the
25 interior of the sleeve every increment thereof
over the entire area thereof between said ends
in order to maintain its cylindrical configuration
during use of the apparatus.
- 30 6. The apparatus according to claim 5, characterized
in that the axially extending spacer means comprise
an elongate rigid cylinder whose outer diameter is less
than the inner diameter of the sleeve which is adapted
to be supported by the apparatus whereby there will be
35 a cylindrical space defined between the outer surface
of the rigid cylinder and the inner surface of the

1 sleeve when it is installed, the said pressure being
supplied into said cylindrical space and the sleeve
thereby being mechanically unsupported throughout its
major length during use.

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7. The apparatus according to claim 6, characterized
in that said means for applying pressure include
means for introducing fluid under pressure in the
framework and transmitting the pressure to said
10 cylindrical space when the sleeve is installed in
place.

8. The apparatus according to claim 5 or 6, charac-
terized in that the means for introducing pressure
15 include at least one passageway through the shaft
means and connecting conduit means between said
passageway and the interior of said sleeve for
applying said pressure on the interior wall of said
sleeve.

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9. The apparatus according to claim 5 or 6, charac-
terized in that the means for introducing pressure
include at least one passageway through the shaft
means and means for establishing a connection bet-
25 ween said passageway and an external source of fluid
under pressure.

10. The apparatus according to claim 6 or 7, charac-
terized in that there is a generally cylindrical
30 inflatable boot sealed to said rigid cylinder and
the means for applying pressure include a conduit
for leading fluid to the interior of the boot to
expand same into engagement with the interior of
the sleeve.

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11. The apparatus according to claims 6 or 7, charac-

- 1 terized in that the opposite ends of the rigid cylinder are provided with respective inflatable cushions adapted to be inflated into engagement with the ends of the sleeve to seal and clamp said
5 sleeve ends between the rigid cylinder and the shaft having a first passageway means for introducing a first fluid under pressure to the interiors of said cushions.
- 10 12. The apparatus according to claim 6 or 7, characterized in that there is a coaxial inflatable boot disposed in the framework telecopically located on the interior of the sleeve and sealed at its ends and structure for leading the fluid to the interior
15 of the boot to inflate the same against the inside surface of the sleeve.
13. The apparatus according to claim 5 or 6, characterized in that there is at least one passageway
20 coaxial with and through said shaft, having its inner end terminating in the interior of the sleeve and its outer end terminating at one of said shaft means ends, a fluid tight connection coupling said sleeve ends, structure for leading fluid under
25 pressure to one shaft means end and into said passageway from the exterior of the framework.
14. The apparatus according to claim 6 or 7, characterized in that the ends of the cylinder have
30 washers closing same off, the shaft means are coaxial with the washers, the disc members are mounted on the shaft means, and the fluid bypasses the cylinder on the exterior thereof.
- 35 15. The apparatus according to claim 14, characterized in that the disc members have inwardly

1 directed axially extending annular flanges and the
sleeve is capable of being secured on the interior
of the flanges.

5 16. The apparatus according to claim 15, characteri-
zed in that said shaft includes a second passageway
means independent of the said one passageway means
to enable introducing a second fluid under pressure
in the said annular space to inflate said sleeve when
10 installed.

17. The apparatus according to claim 5 or 6, charac-
terized in that there are means for mounting said
apparatus for rotation, an external source of fluid
15 under pressure and means establishing a rotatable
fluid coupling leading from said external source of
fluid under pressure to said interior whereby to
apply fluid pressure thereto during rotation.

20 18. The apparatus according to claim 5 or 6, charac-
terized in that the sleeve ends are in coupled "B"
relationship with the respective disc members.

19. The apparatus according to claim 5, characterized
25 in that said elongate framework includes a rigid
hollow cylinder having end washers closing the same
and said shaft means ends respectively are connected
to the respective washers and are axially extending
outwardly relative to said cylinder a coupling on
30 the shaft ends for effecting the rotatable connection
into the printing press, said framework including a
disc member at each end of the cylinder connected
respectively to the shafts and capable for rotation
with said framework, each disc member having a
35 peripheral, annular, axially extending relatively
short flange with the flanges and discs forming

1 cup-like formations opening toward one another and
having the inner diameter thereof larger than the
exterior diameter of said cylinder, at least one of
the discs being movable axially relative to the other
5 disc and capable of being secured in a predetermined
axial position each cup-like formation adapted to have
one end of said sleeve coupled thereto for circularly
shaping same thereby the position of the movable disc
at a location relative to the other disc and the
10 cylinder being fixed when the sleeve is in place so
that the sleeve will form a second hollow cylinder
coaxial of the first cylinder and surrounding the
same and further including a pressurized fluid source,
at least one end of said shaft means including a
15 passageway leading from said shaft means to a space
between cylinders at a location axially outward said
cylinders.

20. The apparatus as claimed in claim 19 character-
20 rized in that a passageway formed through said shaft,
an external source of fluid under pressure and a
connection between said source and said passageway
communicate internally with the interior of the sleeve
when said sleeve is so mounted and coupled.

25
21. Apparatus according to claim 5 or 6, characteri-
zed in that each disc member has the ends thereof
sealably mounted and coupled to said respective ends
of said sleeve, there being no mechanical support pro-
30 vides for said sleeve between its ends when said sleeve
is so coupled, said a spacer being connected between
the shaft ends for fixedly spacing the disc members
apart and maintaining the spacing during the use of
the apparatus.

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22. The apparatus according to in any one of claim 5

- 1 to 21, characterized in that thin-walled metal sleeve
has its ends adhesively engaged with said disc members
in stretched condition.
- 5 23. The apparatus according to any one of claim 1
to 22, characterized in that the sleeve has an exterior
thin film coating of a microcrystalline flexible photo-
conductive material.
- 10 24. Apparatus for supporting an imperforate thin walled
metal sleeve which is flexible and collapsible when
unsupported, for use as an ink transfer device in a
printing press or the like characterized by :
- 15 A. an elongate hollow shaft having a plug at opposite
ends thereafter and lateral passageways through the
shaft wall between the ends thereof,
- 20 B. each of the plugs having structure to enable the
apparatus to be removably coupled to a printing
press and be rotated by the press drive on an axis
defined by the axis of the hollow shaft,
- 25 C. an imperforate disc connected to each of the plugs
coaxial with said shaft and having a circumferential
groove on its face located radially inward of its
outer edge, the diameter of the grooves being sub-
standially greater than the outer diameter of the
hollow shaft, said grooves facing one another
- 30 axially and providing seats for the ends of said
thin walled metal sleeve adapted to be engaged
therein and extending between said discs spaced
outwardly of said hollow shaft,
- 35 D. an elastomeric O-ring engaged in each groove and
a locking ring also axially movable into said

1 groove and adapted to engage said O-ring and press
same into its groove whereby to clamp the ends of
the thin-walled sleeve into the respective grooves
while forming said ends into circles coaxial with
5 said shaft,

E. said apparatus providing no support for the
said sleeve when so installed between the clamped
ends thereof other than fluid pressure,

10

F. means for securing the locking rings in said
clamped engagement and

G. a valve in at least one of said plugs to enable
15 the admission of fluid under pressure into the
interior of the sleeve when said sleeve is so
mounted in said apparatus, the valve being
arranged to retain the fluid pressure in the
apparatus.

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25. The apparatus as claimed in claim 24, character-
ized in that the valve is capable of being opened
to connect the apparatus to an external source of
pressure while mounted in a printing press and ro-
tating.
25

26. The apparatus as claimed in claim 25, character-
ized in that the valve is arranged automatically to
close but retain said pressure if the apparatus is
30 removed from said printing press.

27. The apparatus as claimed in claim 26, character-
ized in that the means for securing the locking
rings comprise bolts extending through said discs
35 from the exterior faces thereof and into engagement
with the clamping rings on the interior of said grooves.

1 28. The apparatus as claimed in claim 27, characterized in that the said structure to enable coupling
of said apparatus to a printing press comprise tapered
sockets formed in each respective plug coaxial with
5 said shaft and at least one of said sockets having
key means, said sockets adapted to be engaged with
male members connected with said printing press, at
least the keyed socket adapted to be engaged with a
male member that is rotary.

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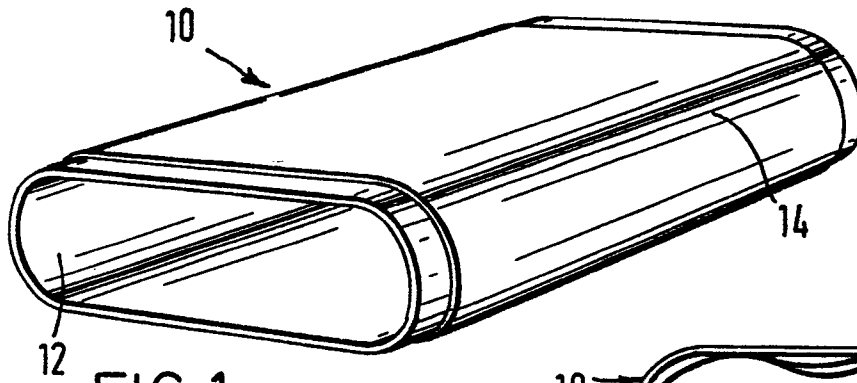


FIG. 1

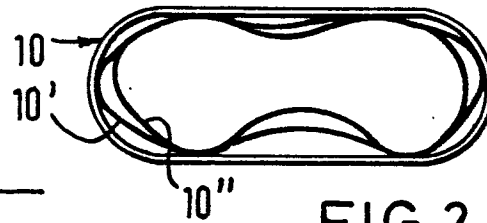


FIG. 2

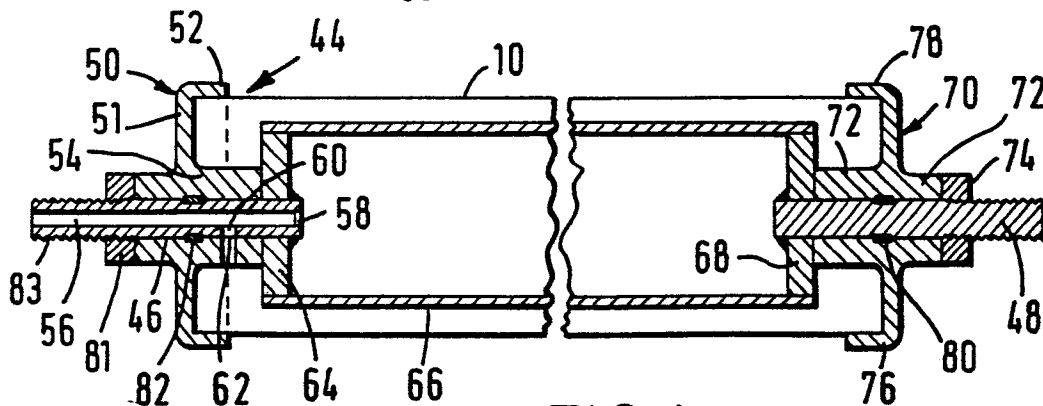
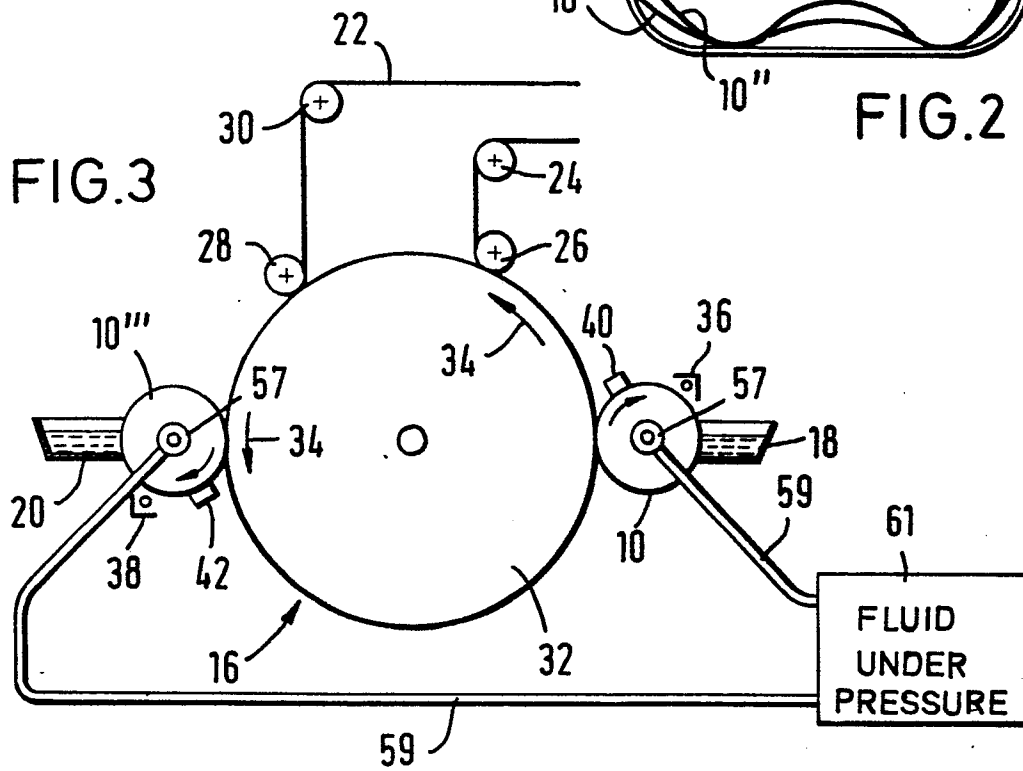


FIG. 4

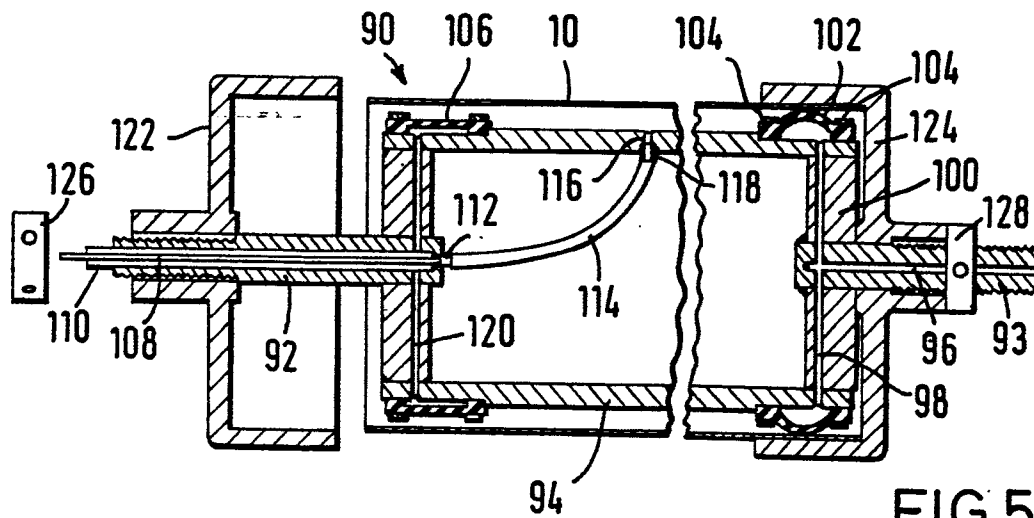


FIG. 5

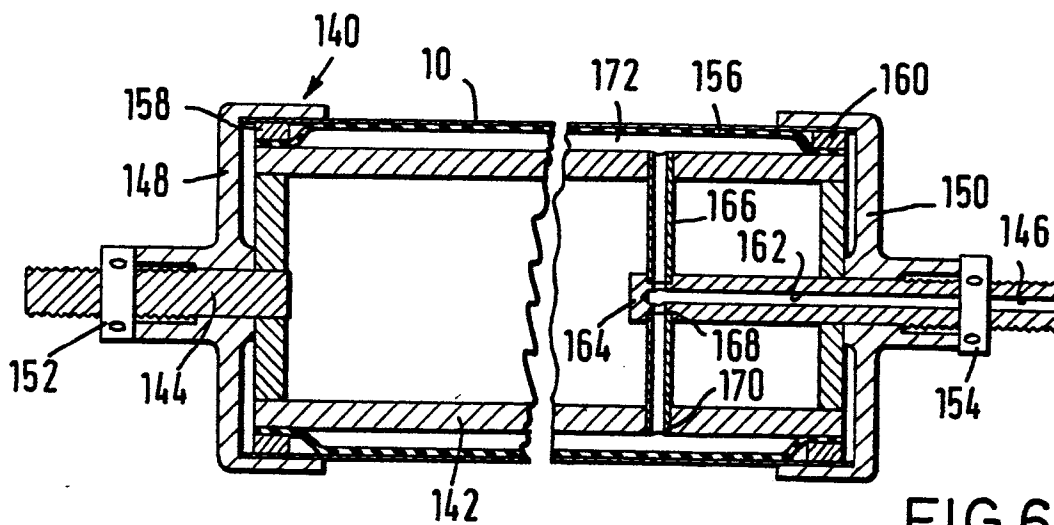


FIG. 6

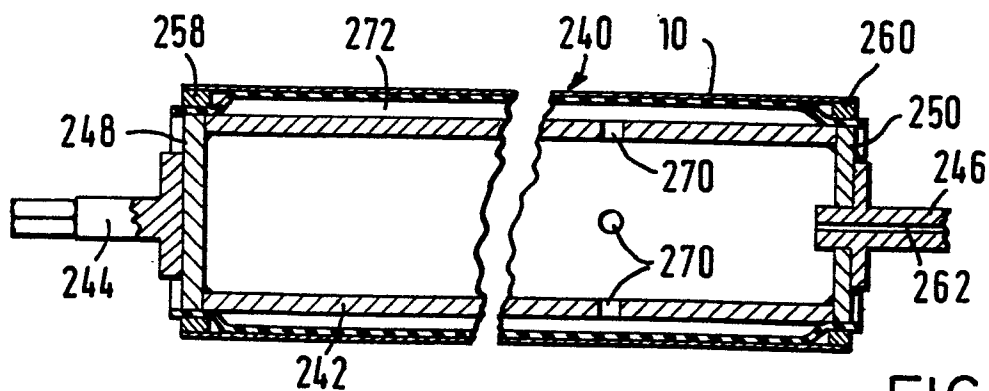


FIG. 7

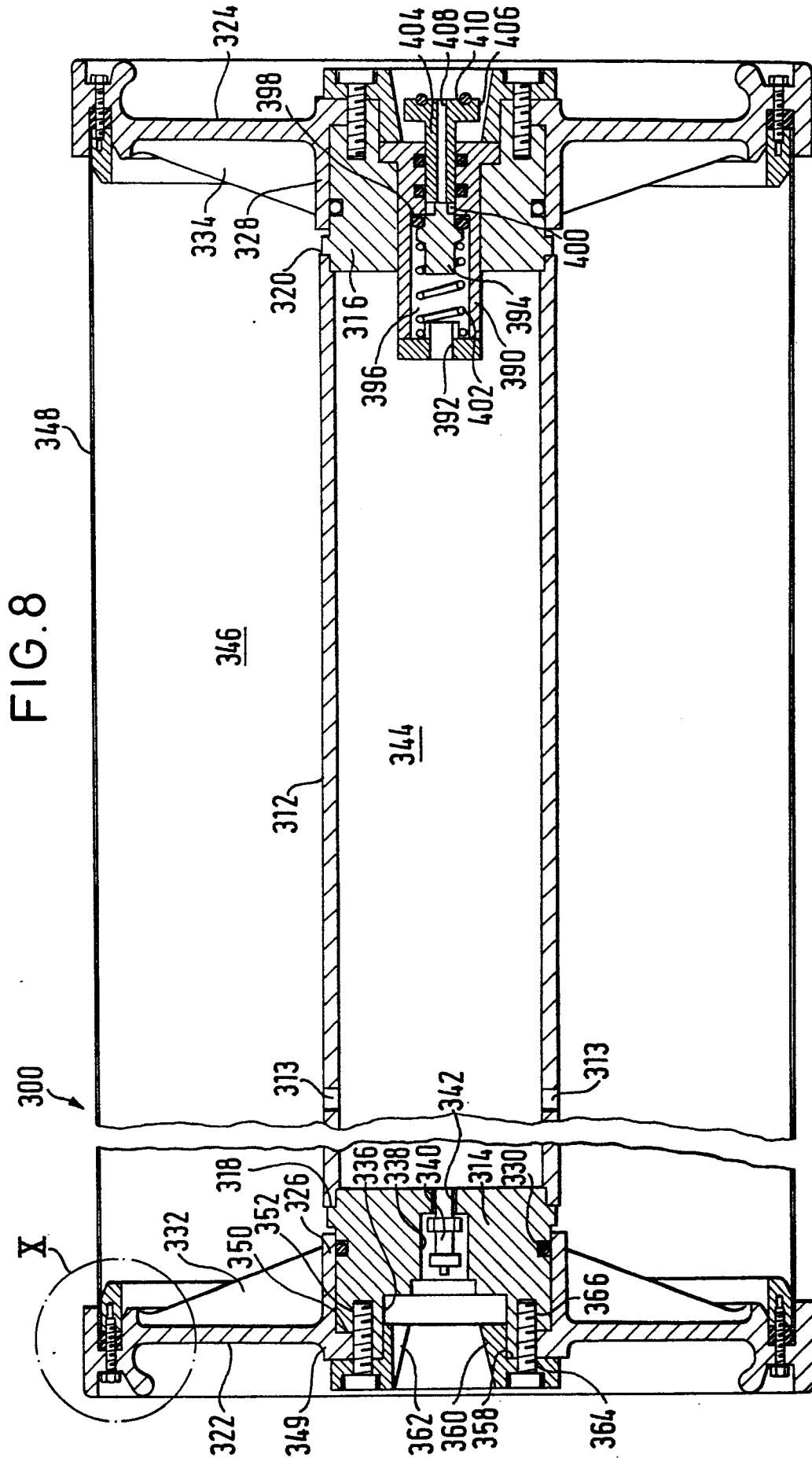
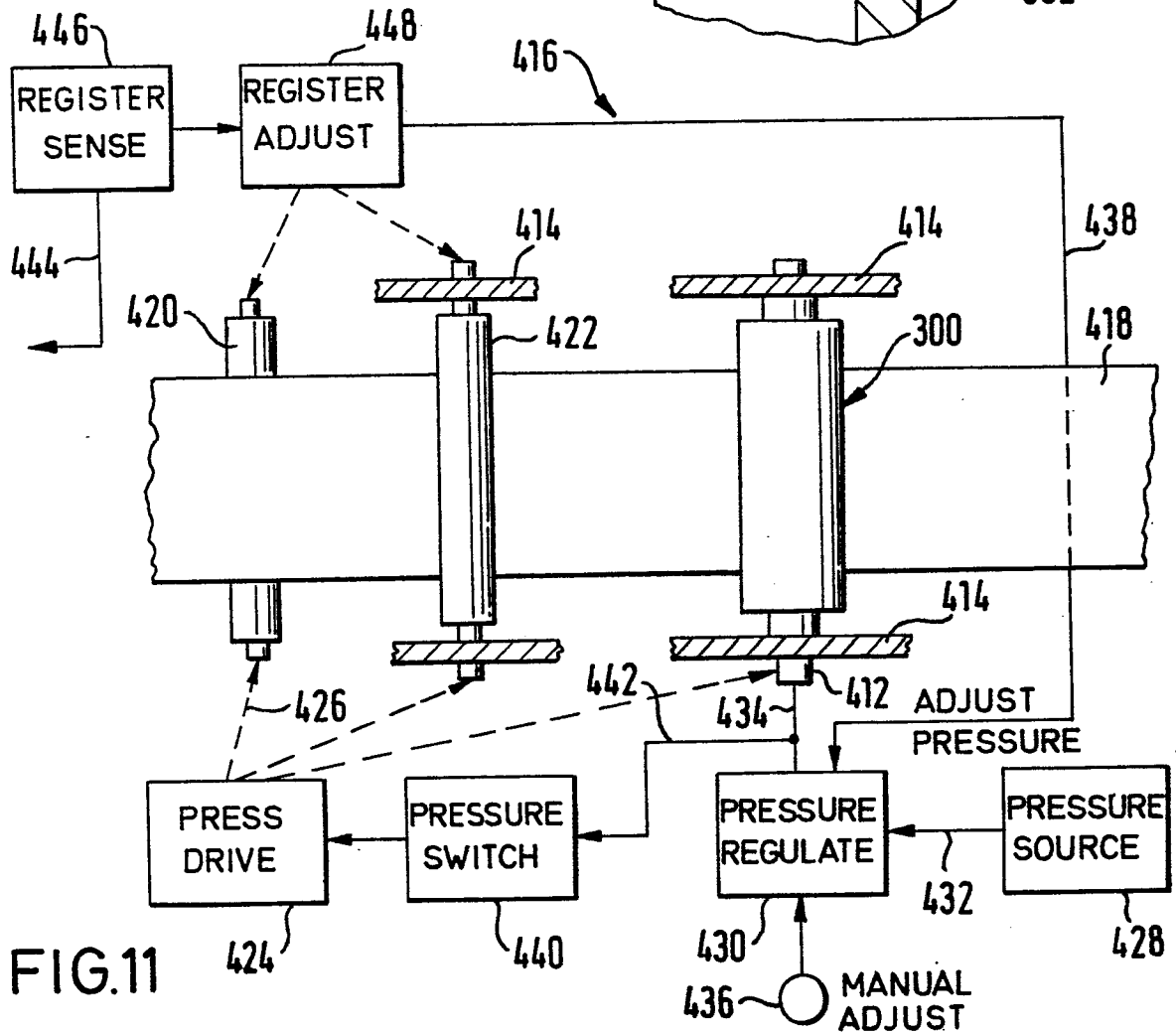
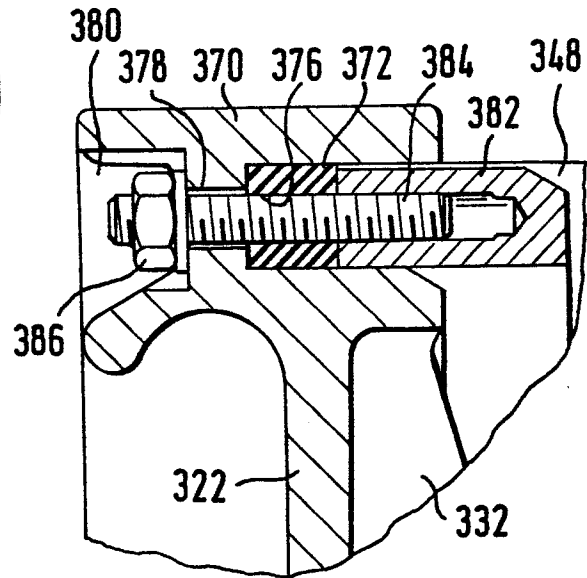


FIG.10





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BAD ORIGINAL

0003051

Application number

EP 78 101 857.7

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
D, A	DE - A - 1 775 267 (J. ZIMMER) * claim 1; page 9; fig. 2 *	1-3, 5-8, 13, 17, 23, 24	G 03 G 15/00 B 41 F 13/08 F 16 C 13/00// G 03 G 15/01
	CH - A-585 352 (CIBA-GEIGY) * fig. 1, 2 *	1-3, 5, 7-9, 13, 17,	
	US - A - 3 695 757 (XEROX) * fig. 1, 4, 5 *	1, 5, 23	TECHNICAL FIELDS SEARCHED (Int. Cl. ²)
	DE - B - 1 181 237 (P. ZIMMER) * position 11 *		B 41 F 13/00 F 16 C 13/00 G 03 G 5/00 G 03 G 13/00 G 03 G 15/00 G 03 G 21/00
	DE - A - 2 021 409 (AGFA-GEVAERT) * fig. 1 *		
A	US - A - 2 986 466 (E.K. KAPRELIAN) * complete document *		CATEGORY OF CITED DOCUMENTS
			X: particularly relevant A: technological background O: non-written disclosure P: intermediate document T: theory or principle underlying the invention E: conflicting application D: document cited in the application L: citation for other reasons &: member of the same patent family, corresponding document
X The present search report has been drawn up for all claims			
Place of search Berlin		Date of completion of the search 26-03-1979	Examiner HOPPE